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CLAIMS

1. A catheter comprising:
a catheter shaft having an insulating material and a diameter; and
5 an ablation electrode forming a junction with the shaft, the ablation electrode having an exposed surface;
wherein, extending from the junction, the exposed electrode surface has a first diameter portion with a first diameter that is smaller than the shaft diameter, the first diameter portion forming an angle with the insulating material; and
10 wherein the exposed electrode surface has a second diameter portion with a second diameter that is larger than the first diameter of the first diameter portion, the second diameter portion having a largest diameter that is smaller than a length of the second diameter portion.
- 15 2. The catheter according to claim 1, wherein the exposed electrode surface further comprises a transition face extending from the first diameter portion to the second diameter portion, the transition face forming an approximately 90 degree angle with the first diameter portion.
- 20 3. The catheter according to claim 1, wherein the insulating material, the first diameter portion and the transition face form a recessed region that allows blood to flow across the first diameter portion and the transition face when the electrode is placed in a blood flow.
- 25 4. The catheter according to claim 1, wherein the ablation electrode further comprises a plurality of recessed regions that allow blood to flow across exposed surfaces of the recessed regions when the electrode is placed in a blood flow.
- 30 5. The catheter according to claim 1, wherein the ablation electrode is a distal tip ablation electrode.

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6. The catheter according to claim 1, wherein the ablation electrode is a ring ablation electrode.

7. The catheter according to claim 2, wherein the transition face forms an
5 approximately 90 degree angle with the exposed surface of the second diameter portion.

8. The catheter according to claim 2, wherein the distance from the
insulating material to the transition face along the first diameter portion is larger than
10 0.3 millimeters.

9. The catheter according to claim 1, wherein the distance from the
insulating material to the transition face along the first diameter portion is less than
the diameter of the first diameter portion.

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10. The catheter according to claim 1, wherein the distance from the
insulating material to the transition face along the first diameter portion is
approximately 0.9 millimeters.

20 11. The catheter according to claim 1, wherein the transition face extends
at least 0.3 millimeters toward a center longitudinal axis of the electrode from the
exposed surface of the electrode.

12. The catheter according to claim 2, wherein the recessed region
25 encircles the ablation electrode.

13. The catheter according to claim 1, wherein a largest diameter of the
electrode is no larger than a diameter of the insulating material forming the first
sidewall.

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14. The catheter according to claim 1, wherein the transition face is parallel to a distal end of the catheter shaft.

15. The catheter according to claim 1, wherein the first diameter portion
5 and the insulating material form an angle of approximately 90 degrees.

16. The catheter according to claim 1, wherein the first diameter portion and the insulating material form an angle of more than 90 degrees.

10 17. The catheter according to claim 1, wherein the first diameter portion and the insulating material form an angle less than 90 degrees.

18. The catheter according to claim 1, wherein the ablation electrode is approximately four millimeters in length.

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19. A catheter comprising:
a shaft including an electrically insulating material; and
an ablation electrode forming a junction with the insulating material and
having an exposed surface that forms a channel with the insulating material; wherein
20 a base of the channel is the exposed electrode surface of a first
diameter portion of the electrode;
a first sidewall of the channel is the insulating material;
a second sidewall of the channel is the exposed electrode surface of a
second diameter portion of the electrode; and
25 a length of the second diameter portion of the electrode is greater than
a diameter of the second diameter portion.

20. The catheter according to claim 19, wherein the second sidewall forms an angle of less than 120 degrees with the channel base.

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21. The catheter according to claim 19, wherein the channel allows blood to flow across the channel base and the second sidewall when the electrode is placed in a blood flow.

5 22. The catheter according to claim 19, wherein the ablation electrode further comprises a plurality of channels that allow blood to flow across exposed surfaces of the channels when the electrode is placed in a blood flow.

23. The catheter according to claim 19, wherein the ablation electrode is a
10 distal tip ablation electrode.

24. The catheter according to claim 19, wherein the ablation electrode is a ring ablation electrode.

15 25. The catheter according to claim 19, wherein the second sidewall forms an approximately 90 degree angle with the channel base.

26. The catheter according to claim 19, wherein the distance from the first
sidewall to the second sidewall along the base is more than 0.3 millimeters.
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27. The catheter according to claim 19, wherein the distance from the first
sidewall to the second sidewall along the base is less than a diameter of the first
diameter portion.

25 28. The catheter according to claim 19, wherein the second sidewall extends at least 0.3 millimeters toward a center longitudinal axis of the electrode from an outer surface of the electrode.

29. The catheter according to claim 19, wherein the channel encircles the
30 ablation electrode.

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30. The catheter according to claim 19, wherein a largest diameter of the electrode is no larger than a diameter of the insulating material forming the first sidewall.

5 31. The catheter according to claim 19, wherein the ablation electrode is approximately four millimeters in length.

32. A catheter comprising:
a catheter having an insulating sheath; and
10 an ablation electrode non-moveably attached to the insulating sheath, forming a junction with the insulating sheath, and having an exposed surface that forms a channel with the insulating sheath; wherein
a base of the channel is the exposed electrode surface;
a first sidewall of the channel is the insulating sheath;
15 a second sidewall of the channel is the exposed electrode surface; and
a width of the base of channel is at least one-tenth of the size of the largest diameter of the electrode and less than the smallest diameter of the electrode.

20 33. The catheter according to claim 32, wherein the electrode is a distal tip electrode.

34. The catheter according to claim 32, wherein the electrode is a ring electrode.

25 35. A method of manufacturing a catheter tip, comprising:
providing a catheter shaft with an insulating sheath;
providing an ablation electrode having a first diameter portion with an exposed surface and a second diameter portion with an exposed surface, the first and second diameter portions forming a transition face, and the second diameter portion
30 having a length that is larger than a largest diameter of the second diameter portion;
and

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attaching the electrode to the shaft, wherein the transition face and the sheath form sidewalls of a channel and the first diameter portion of the electrode forms a base of the channel.

- 5 36. The method according to claim 35, wherein attaching the electrode to the shaft results in the base of channel being at least 0.9 millimeters wide from sidewall to sidewall.